

Tree cover in the Taiga-Tundra Ecotone (TTE) : Landsat-based uncertainty and validation



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Climate change is expected to alter the treeline. A validated moderate resolution baseline is required to monitor change.

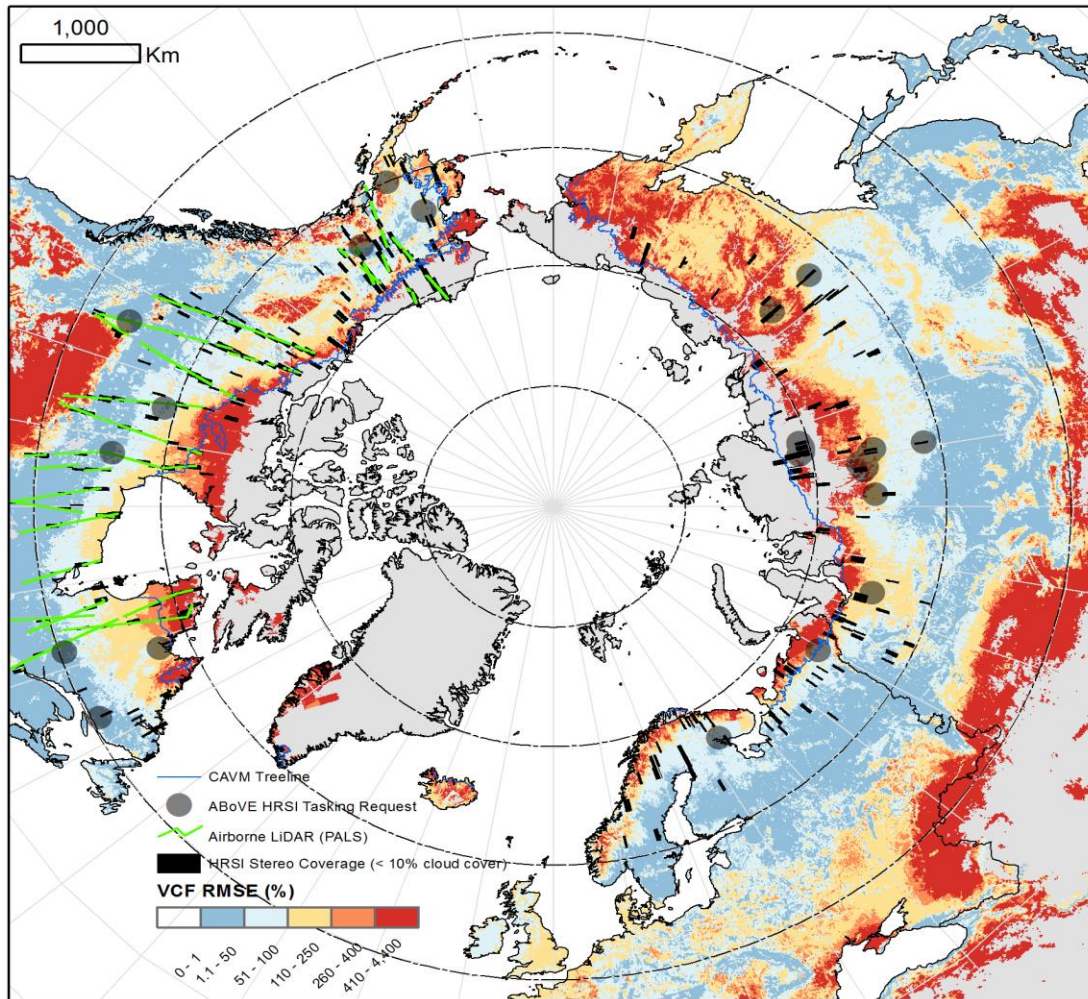


Fig. 1 Landsat Vegetation Continuous Fields (VCF) estimates of % tree cover uncertainty in the TTE, circa 2000 (Sexton *et al.* 2013).

Groups of forest patches describe ecotone form

DigitalGlobe WorldView-2 NextView 2013

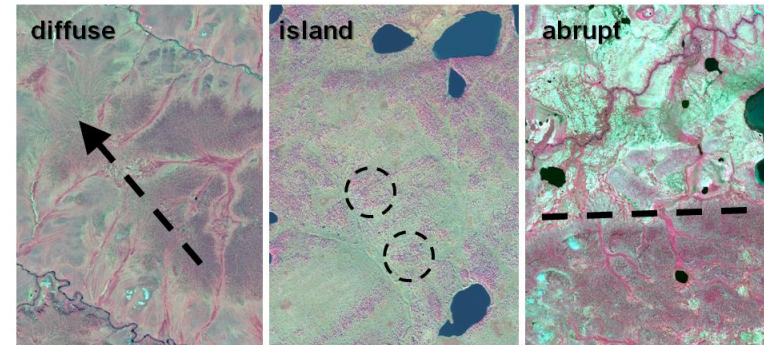


Fig.2 WorldView-2 examples of treeline in the TTE for VCF validation.

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Study Objectives:

1. Use recently available Landsat based percent tree cover maps, circa 2005, with estimates of uncertainty to improve our prior circumpolar arctic-boreal transition assessment.
2. Use high-resolution panchromatic and stereo data in intensive study sites along the forest-tundra transition zone and characterize the spatial patterns of the tree-tundra mosaic across the boundaries.
3. Estimate forest cover and biomass change in intensive study site transects using high-resolution stereo satellite data, field observations, and allometry.



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Abstract:

Global satellite vegetation canopy data tend to overestimate tree canopy in sparse forests. In the circumpolar taiga-tundra ecotone (TTE) this overestimation increases the uncertainty in depictions of tree cover, where small changes may reflect critical site-level drivers of forest dynamics. This work will validate the recent Landsat-derived Vegetation Continuous Fields (VCF) dataset for the circumpolar TTE using estimates of tree cover derived from multiple high-resolution tree cover sources.

References:

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- 2009 Montesano, P.M., Nelson, R., Sun, G., Margolis, H., Kerber, A., Ranson, K.J. 2009. MODIS tree cover validation for the circumpolar taiga-tundra transition zone, *Remote Sensing of Environment*, 113:2130-2141.

Technical Description of Images:

Figure 1. A preliminary 2005 estimate of percent tree cover uncertainty derived from the Landsat VCF tree cover product (Sexton et al. 2013)

Figure 2. WorldView-2 examples of treeline in the TTE. High-resolution data with supercomputing are needed to understand TTE structure.

Scientific significance:

The spatial distribution of tree cover in the poorly understand at moderate and high resolution across the full circumpolar domain. Refined estimates of tree cover in the TTE will help inform analyses of tree cover change and tree structure vulnerability in the TTE.

Relevance for future science and relationship to Decadal Survey:

Forest carbon is a critical component of the carbon cycle, and is sensitive to climate change and disturbances. Forest structure observations from high-resolution commercial instruments are available at no direct cost through the National Geo-spatial Intelligence Agency (NGA) NextView license agreement with DigitalGlobe. Combining these data with Landsat forest cover estimates, airborne and field measurements, one could provide the necessary data products to infer aboveground carbon stock in forests to the northern limit worldwide.